REMARKS / ARGUMENTS

The Examiner states in the Examiner's Response that "Nichani discloses an image-feature-position-based inspection method as broadly claimed, citing various portions of Nichani as support.

Applicant will explain what an "image-feature-position-based inspection method is, and why that language cannot be interpreted so broadly as to include anything that Nichani teaches.

First, it's necessary to realize that Nichani had to solve the problem of detecting marks in the little boxes on a film package, as shown in Figs. 1 and 2. Since there's an infinite variety of possible marks, if an "image-feature-position-based inspection method" was used by Nichani, such as Golden Template Analysis, then an infinite variety of templates would be needed to detect marks in each box. One of average skill in machine vision would know that the memory and computational requirements would be enormous, and therefore prohibitive. So, Nichani was forced by this fact alone to limit the objective of the inspection of the marks in the boxes. In particular, Nichani limited the inspection to determining the "presence/absence" of a check mark. See Nichani at col. 13, lines 40-46.

The claims have been amended so as to EXCLUDE presence/absence inspection, such as taught by Nichani. The inspection method taught by Nichani

at col. 13 cannot inspect particular image features, precisely because those image features can be in ANY position within the box, due to the hand-made nature of the marks (either check marks, or x-marks, or tick marks, etc.). The method taught by Nichani at col. 13 is INDEPENDENT of position, and consequently does **not** require A PRIORI knowledge of where the mark will be made inside the box for the mark to be detected.

By contrast, the inspection method taught and claimed by Applicant requires a priori knowledge in the form of model images or known Golden Templates. For example, claim 1 requires: "training only a fine search tool and an image-feature-position-based inspection tool for a respective single model for each of the plurality of non-overlapping sub-regions". This is clearly NOT taught by Nichani.

Nevertheless, the Examiner asserts that Nichani teaches such an inspection method at col. 5, lines 23-34, 49-54, col. 6, lines 9-21, col. 9, lines 1-9, col. 11, lines 6-46, and col. 13, lines 40-67, col. 14, lines 1-35. The Applicant will now show that Nichani does not, by any breadth of interpretation of the claims as amended previously, teach an inspection method as now claimed.

At col. 5, lines 23-34, Nichani merely teaches that the vision system is adapted to "inspect photo packages and report the status of various check boxes". This is consistent with the "presence/absence" teaching described above. This is NOT teaching or suggesting anything like the specificity of

Applicant's claim language requiring: "an image-feature-position-based inspection tool". Nichani here is SILENT on anything about reporting the position of an image feature. One of average skill in machine vision knows that the method taught by Nichani cannot possibly determine and report the position of any image feature **within** the check box. Thus, it is NOT possible to read such claim language broadly enough to read on Nichani.

At col. 5, lines 49-54, Nichani merely discusses a trigger mechanism so that the vision system knows that there is an object present to be inspected. The claim language of Applicant does NOT read on this portion of Nichani.

At col. 6, lines 9-21, Nichani discusses Fig. 5, which talks about alignment of individual boxes so as to determine the position of the box, but NOT to inspect the contents of the box. Consequently, there is NO discussion of "an image-feature-position-based inspection tool" for inspecting the actual contents of the box, as required by Applicant's claims. Thus, the claim language of Applicant does NOT read on this portion of Nichani.

At col. 9, lines 1-9, Nichani deals only with locating the position of the checkboxes, but NOT with how they are inspected within each box. Therefore, the claim language of Applicant does NOT read on this portion of Nichani.

At col. 11, lines 6-46, Nichani teaches only coarse alignment of the position of the boxes, but NOT how the contents within each box are inspected. Accordingly, the claim language of Applicant does NOT read on this portion of Nichani.

At col. 13, lines 40-67, Nichani teaches specifically how the inside of each checkbox is inspected: using a presence/absence detection method. This is the OPPOSITE of what is claimed by applicant. Accordingly, the claim language of Applicant does NOT read on this portion of Nichani.

At col. 14, lines 1-35, Nichani continues the teaching of the presence/absence detection method. Accordingly, the claim language of Applicant does NOT read on this portion of Nichani.

The Examiner asserts that although Nichani does not disclose an inspection method such as Golden Template Analysis or PatInspect, "Nichani discloses an inspection method based on the position of the check boxes in an image, citing again col. 9, lines 1-9. ***Key Point*** Nichani teaches a multi-step method, such as shown in Fig. 4. Note well that "check mark detection" is not shown as a step in ANY of the figures of Nichani, but it is described at col. 13 after the last step of fine alignment 60 of Fig. 4 is described at col. 12. **The Examiner seems to be missing the distinction between locating a box, and inspecting it's contents.**

By contrast, Applicant's claims include multiple steps that clearly call out for location first, and then inspection using a very specific category of inspection ... that of image-feature-position-based inspection.

So, Nichani does NOT use "an inspection method based on position of the check boxes in an image to inspect the INSIDE of the check boxes. On the contrary – it is clear from col. 13 of Nichani that only presence/absence analysis is performed inside each check box, and therefore, the position of any feature within the check box is LOST by virtue of the fact that only presence/absence analysis is employed.

The Examiner asserts that Nichani does not teach away from using a single search tree, citing Fig. 7. However, Fig. 7 is merely a minimum spanning tree that is merely one element of the Minimum Spanning Forest that is taught throughout Nichani, such as in the Abstract wherein it states in the third sentence therein that "a minimum spanning forest (MSF) is generated defining the characteristics of interest as vertices with each vertex referencing a vertex closest to itself in order to minimize the sum of the distances between vertices in each minimum spanning tree (MST) of the MSF." One of average skill in the art of Minimum Spanning Trees would see that this sentence would make no sense if there were only one MST. Thus, having only one MST is NOT a design choice,

because Nichani teaches a Minimum Spanning Forest, which by definition MUST have more than one tree.

Fig. 7 was included to discuss the constituent MSTs of the MSF of Nichani. For example, in col. 10, lines 9-11, Nichani states that "each MST, in this illustrative embodiment, is a doubly linked list, as illustrated in FIG. 7".

The Examiner asserts that the number of trees would be a matter of design choice depending on the number of alignment points, apparently based on the statement in col. 10 that "in an alternative embodiment, the number of trees can be manually input". There is nothing in this statement that suggests that a single alignment point is possible. Nichani's statement implies necessarily that there be a plurality of alignment points, and consequently, a plurality of trees, thereby guaranteeing the presence of a MSF (a forest of trees). Further, more than one alignment point is NECESSARY due to the NON-RIGID nature of the surface to be inspected by Nichani. It would make no sense at all to use only one alignment point ... that would subvert the essential purpose of the methods taught by Nichani. ALL of Nichani is consistent with an interpretation that there are a plurality of alignment points, and therefore a plurality of MSTs to create a MSF. Thus, it is clearly FALSE that the number of trees could ever be simply chosen to be one tree.

Regarding Udea, Applicant acknowledges that Udea teaches non-overlapping sub-regions. Nevertheless, Udea does not repair any deficiency of

Nichani, so combining Udea with Nichani does not result in Applicant's invention. Applicant's invention is patentable even in view of the teaching of Udea.

The Examiner asserts that Nichani discloses only a fine search tool, citing col. 7, lines 16-30, and col. 8, lines 30-57. However, at col. 7, lines 16-17 clearly states that "the position of each of these coarse alignment models or fixturing points is stored at train time 78 for use at run time". So, it's clear that a coarse search tool is ALSO taught by Nichani. See also Fig. 4, elements 56, 58, and 60. Not only is coarse alignment taught, but ALSO local alignment !!

At col. 13, lines 40-67, Nichani teaches specifically how the inside of each checkbox is inspected: using a presence/absence detection method. This is the OPPOSITE of what is claimed by applicant. Accordingly, the claim language of Applicant does NOT read on this portion of Nichani.

At col. 14, lines 1-35, Nichani continues the teaching of the presence/absence detection method. Accordingly, the claim language of Applicant does NOT read on this portion of Nichani.

Regarding Companion, the Examiner asserts that Companion discloses an image-based inspection method. However, Applicant no longer claims an "image-based" inspection method, instead claiming the more restrictive "image-

feature-position-based" inspection. Accordingly, Companion teaches a variety of ways to analyze a difference image in Fig. 3, but does not teach anything resembling Golden Template Analysis, or PatInspect, which are both specific embodiments of the general concept of "image-feature-position based inspection", i.e., an inspection method based on inspecting the positions of specific image features. In fact, Companion does NOT disclose or suggest such a method.

The Examiner has asserted that Nichani and Companion are combinable because they are from the same field of endeavor. First, this is not enough to combine for purposes of demonstrating obviousness. I believe that the Examiner is well-aware that there must be some suggestion to combine clearly evident in at least one of the references. No such evidence is present in either Nichani or Companion. However, even if these two references were combined, since neither of them teach an "image-feature-position based inspection", the result would NOT be Applicant's invention as now claimed.

Secondly, the Examiner has defined the field of endeavor of each of the references so broadly as to have them intersect. However, this is arbitrary, and the fields of endeavor could also have been defined so as not to overlap. For example, Nichani teaches a presence/absence analysis within the check boxes, whereas Companion does not.

In light of these remarks, please reconsider the following remarks, previously presented.

To make more clear the distinction between Applicant's invention and the prior art, the claims have been amended such that an image-feature-position-based inspection tool is required in all the claims. Both Golden Template Analysis and PatInspect are examples of image-feature-position-based inspection tools.

In the case of Golden Template Analysis, a Golden Template is compared with a run-time image. Any image features, such as single pixels, or patterns of pixels, that are not in the correct **position** are indicated as defects. Likewise, PatInspect is capable of detecting incorrectly positioned features of an image.

By contrast, Nichani teaches three parameters that together are used to determine the presence/absence of a check-mark (Col. 13, lines 40-57). The three parameters are average of the gray level value, edge count, and shape score are all AGGREGATE measures of an image, each excluding position information. Each of the three parameters taught by Nichani **cannot** convey position data for each image feature. Computing each of the three parameters **loses** individual feature position information. Thus, Nichani does NOT teach or suggest an image-feature-position-based inspection tool. By contrast, Golden Template Analysis and PatInspect, and other image-feature-position-based

inspection tools preserve and analyze feature position information for each image feature in an image to be inspected.

Further, Nichani teaches away from employing any image-feature-position-based inspection tool. Since Nichani states that "it is desired to determine which check boxes in a group of boxes are checked" (col. 13, lines 41-42), one of average skill in the art would avoid using an image-feature-position-based inspection tool. This is because one of average skill in the art of machine vision would know that to use an image-feature-position-based inspection tool for detection of check marks in a box would be prohibitively complex, involving an enormous set of templates to account for the many possible check marks that can be made in a box. This level of complexity can be avoided, however, since simple presence/absence tests can be used that ignore the specific positions of all the millions of possible hand-drawn check marks. In fact, that's why Nichani teaches merely detecting the presence/absence of check marks (col. 13, lines 45-47), and not actually inspecting the checkmarks themselves.

The Examiner asserts that Nichani does not teach away from using a single tree, stating that Nichani discloses a single search tree in Fig. 7. However, Nichani states clearly that "Fig. 7 is an abstraction illustrating a Minimum Spanning Tree effected with a one dimensional linked list" (col. 5, lines 14-15), also stating that "each MST, in this illustrative embodiment, is a doubly linked list ... formed by pointers stored in the individual box data structure(s)" (col. 10, lines

9-12). Thus, Fig. 7 merely illustrates the structure of an illustrative Minimum Spanning Tree. Nowhere in Nichani is a statement that the minimum spanning tree shown in Fig. 7 could function alone, without other minimum spanning trees so as to form a minimum spanning forest.

A minimum spanning forest is a necessary aspect of Nichani. For example, in the Abstract, Nichani states that "The fine alignment process uses the minimum spanning forest ("MSF") to locate each characteristic of interest in a selected order by reference to another, nearest, previously located characteristic" (Abstract, lines 20-23). The fine alignment process is a major aspect of Nichani (see col.12 – col. 13). Without fine alignment, Nichani would not function adequately. Consequently, Nichani requires a Minimum Spanning Forest. Therefore, Nichani does NOT teach the use of only a single Minimum Spanning Tree, as shown in Fig. 7. Thus, Nichani DOES teach away from using a single search tree.

The Examiner continues to assert that "the number of trees would be a matter of design choice depending on the number of alignment points". However, Nichani merely states that "In an alternative embodiment, the number of trees can be manually input" (col. 10, lines 2-3). Note well that "trees" used in this citation to Nichani is plural – Nichani contemplates **more** than one tree. In fact, Nichani repeatedly refers to a plurality of Minimum Spanning Trees throughout the specification -- Nichani does not teach, suggest, or motivate any design choice involving only a single Minimum Spanning Tree. Also note well

that Nichani makes NO mention that the user has free choice, only that the number of trees can be manually input. In fact, there is no choice, since the method of Nichani requires that the number of trees reflect the number of alignment points (col. 9, lines 64-67).

Further, even if there were a case where there was only one alignment point, there MUST be only one Minimum Spanning Tree – no choice is involved. This is because "each local alignment point serves as a root of a tree, so the number of trees can be determined by processing the individual box data structures to obtain local alignment point information." (col. 9, lines 65-67, col. 10, line 1). BUT, there can be NO case in which only one alignment point would be present, since "each local alignment point is associated with one or more geographical groupings of characteristics of interest, e.g., check box(es), and when the exact position of each local alignment point is determined the approximate position of respective characteristics or check boxes associated with the local alignment point is then known." (col. 4, lines 12-17). Thus, if there were only ONE local alignment point, it would not be just a local alignment point – it would be GLOBAL in that ALL geographical groupings of characteristics of interest would be associated with the single local alignment point. Yet, this is not possible, since Nichani discusses a method and apparatus for inspection of characteristics on non-rigid packages, i.e., packages that are NOT flat, such as film cartridge development packages (see Title and Fig. 1). Such non-rigid surfaces require MULTIPLE local alignment points, and therefore, multiple

Minimum Spanning Trees, i.e., a Minimum Spanning Forest. By contrast, Applicant claims only a **single** search tree.

Regarding Ueda, although Ueda clearly shows dividing a region of interest in its entirety into a plurality of non-overlapping sub-regions, Ueda does NOT teach any inspection method, instead teaching a character recognition method. The output of such a method is a character code. (see Abstract, lines 9-15) By contrast, Applicant claims a method for **inspecting** a spatially distorted pattern. The end result of the now-claimed image-feature-position-based inspection is a difference image, a match image, a distortion vector field, and/or a pass/fail determination. Note well that Applicant's claims not just dividing a region of interest in its entirety into a plurality of non-overlapping sub-regions, but "dividing the region of interest in its entirety into a plurality of non-overlapping sub-regions, **a size of each of the non-overlapping sub-regions being small enough such that an image-feature-position-based inspecting tool can reliably inspect each of the sub-regions**", as in amended claim 1, for example. By contrast, Ueda is silent on what size each of the sub-regions must be, and provides no mechanism or method for **reducing** the size of the sub-regions so as to ensure reliable character recognition.

The Examiner asserts that Nichani discloses both coarse alignment and fine alignment, and that the claim language does not exclude the use of a coarse alignment tool. However, in Applicant's invention, as now claimed in amended independent claims 1, 6, 14, 21, 27, 34, 35, and 36, for example, **only** a **fine** search tool is used to search within a **plurality** of non-overlapping sub-regions, whereas in Nichani, a **coarse** alignment tool searches in the plurality of windows (sub-regions), as stated in Col. 7, lines 43-46.

Accordingly, Applicants assert that the present application is in condition for allowance, and such action is respectfully requested. The Examiner is invited to phone the undersigned attorney to further the prosecution of the present application.

Respectfully Submitted,

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